

Validation of MODIS-Aqua Deep Blue Aerosol Products over Bright Surfaces

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INTRODUCTION

The Deep Blue aerosol retrieval algorithm utilizes the blue channels of the MODIS sensor to infer properties of aerosols over bright surfaces. Recent updates to the algorithm, here referred to as 'Collection 5.1', have led to improved agreement with collocated AERONET observations.

SUMMARY OF CHANGES IN COLLECTION 5.1

Collection 5.1 includes several updates, most significantly:

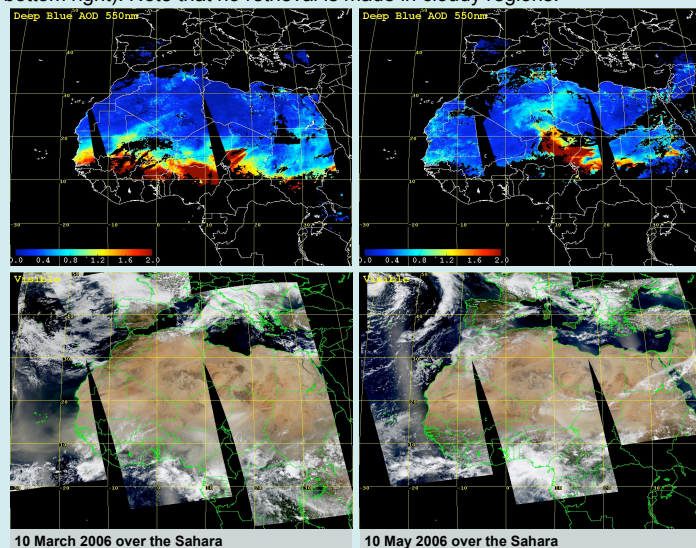
- (1) parameterization of BRDF effect on surface reflectances over desert
- (2) improvement of the cloud screening procedures
- (3) improvement on the classification of QA/QC flags

AVAILABILITY

Deep Blue Collection 5.1 will be incorporated in the upcoming MODIS-Aqua reprocessing, set to begin soon. Deep Blue will be included for the first time in the MODIS-Terra reprocessing later this summer.

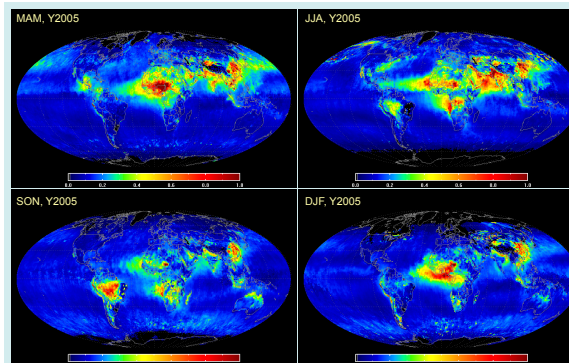
EXAMPLES

Images of Deep Blue Aerosol Optical Thickness (AOT) (below, top row) and their corresponding visible composites (bottom row) illustrate how Deep Blue captures aerosol properties over the bright surface of the Sahara. On 10 March 2006, the result of a large dust outbreak event is clearly visible over the ocean (bottom left), and Deep Blue maps the plume over land (top left). On 10 May 2006, a more localized dust feature is present (top and bottom right). Note that no retrieval is made in cloudy regions.



References

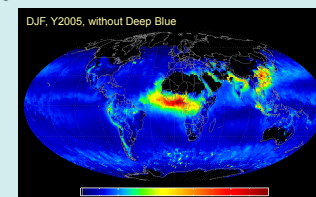
Ichoku, C., D. A. Chu, S. Mattoo, Y. J. Kaufman, L. A. Remer, D. Tarré, I. Slutsker, and B. N. Holben. A spatio-temporal approach for global validation and analysis of MODIS aerosol products. *Geophys. Res. Lett.* 29(12):10.1029/2001GL013206, 2002.



THE DEEP BLUE ADVANTAGE

Deep Blue is an important addition to the MODIS Level 2 Aerosol Product. Because the Dark Target Land and Ocean algorithms do not retrieve over bright surfaces, Deep Blue fills in significant data gaps (below right). With Deep Blue, aerosol properties over important source regions, including the Sahara Desert, can be quantified.

At left, global maps of 2005 seasonal AOT averages are constructed by combining Dark Target (Land and Ocean) with Deep Blue retrievals.



VALIDATION METHODOLOGY

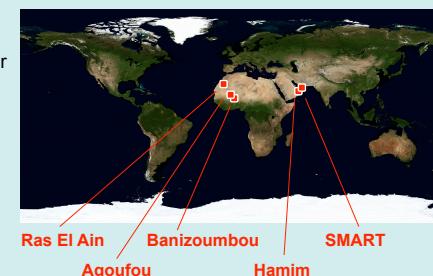
Deep Blue AOT is compared to AERONET sun photometer data using the MODIS Atmosphere Parameters Subset Statistics (MAPSS) collocation tool (Ichoku et al., 2002). For this study, the average of all AERONET (level 2.0, quality assured) observations +/- 30 minutes of the MODIS-Aqua overpass time is combined with the MODIS value for the pixel containing the AERONET site to form a collocated pair.

DATA

Results are shown for two validation datasets:

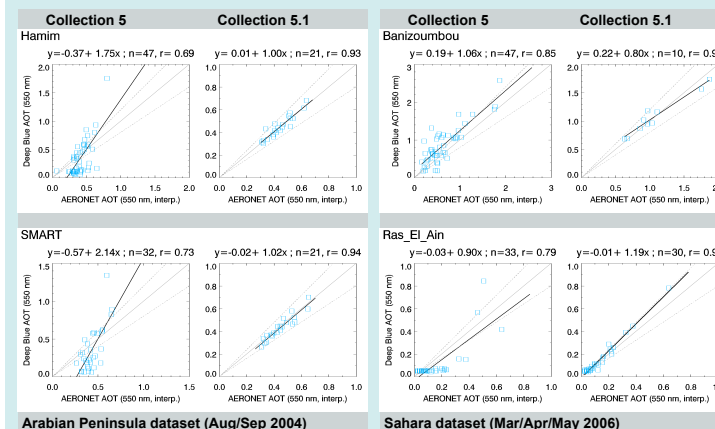
- (1) August-September 2004 covering the Arabian Peninsula
- (2) March-April-May 2006 covering the Sahara Desert

The map at right shows selected AERONET sites used for the scatterplots below.



RESULTS BY SITE

Collocated AOT (550 nm) is plotted for Collection 5 (left column) and Collection 5.1 (right column) Deep Blue data for select AERONET sites. For Collection 5.1, only high quality data ("Very Good") is used. No QA filtering is implemented for Collection 5. Dashed grey lines are +/- 20%. The thick black line represents the line of best fit. The corresponding equation, along with the number of collocated pairs (n) and Pearson's linear correlation coefficient (r) is given at the top of the plot. Note different scales.



COMPARISON AT OTHER WAVELENGTHS

In addition to 550 nm, Deep Blue retrieves aerosol properties at 412, 470 and 650 nm. Early results for Collection 5.1 show consistent agreement across all wavelengths (below), indicating proper spectral dependence in models used for retrievals.

